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Fujitsu Semiconductor (Shanghai) Co., Ltd.
Application Note

MCU-AN- 500064-E-10

F²MC-8FX FAMILY

8-BIT MICROCONTROLLER

MB95310/370 SERIES

LCD SOURCE CODE API

APPLICATION NOTE

FUJITSU

Revision History

Date	Author	Change of Records
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This manual contains 16 pages.

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1 Introduction

This document introduces API for LCD code.

In MB95F310 MCU there is an LCD module which can drive LCD panel by SEG and COM pin. In following chapters we should describes the MB95F310 LCD register and code in C.

2 MB95F310 LCD register

This chapter describes MB95F310 LCD register.

The LCD controller contains 20 bytes of display data memory and controls LCD display via 4 common outputs and 40 segment outputs. It offers a choice of three different duty outputs to directly drive the LCD panel. Figure 2-1 describes the recommended duty setting.

Bias	1/2 Duty	1/3 Duty	1/4 Duty
1/2 bias	❍	×	×
1/3 bias	×	❍	❍

❍ : Recommended mode
× : Prohibited

Figure 2-1: Duty Setting

2.1 LCDCC (LCDC Control Register)

This register is used to set the clock, display mode, and power supply control.
Figure 2-2 describes the register LCDCC.

Address	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	Initial value
$0FC4_H$	CSS	LCDEN	VSEL	BK	MS1	MS0	FP1	FP0	00010000_B

Figure 2-2: LCDCC Register

Table 2-1 describes every bit of LCDCC.

Table 2-1: LCDCC Register Description

Register	Description
CSS	Frame period generation clock select bit, when “0” is written, main clock is selected, or else sub clock is selected.
LCDEN	When “0” is set, LCD display is stopped; When “1” is set, LCD display continues even after transition to main stop or watch mode.
VSEL	Writing “0” will enable external resistor. Writing “1” will enable internal resistor.
BK	Writing “1” will enable display blanking.
MS1	Selects LCD duty, refer to Table 2-2.
MS0	Selects LCD duty, refer to Table 2-2.
FP1	Frame period select bit, refer to Table 2-3.
FP0	Frame period select bit, refer to Table 2-3.

Table 2-2 describes duty setting.

Table 2-2: Duty Set

MS1	MS0	Duty Description
0	0	LCD operation halt
0	1	1/2 duty
1	0	1/3 duty
1	1	1/4 duty

Table 2-3 describes frame period select.

Table 2-3: Frame Period Set

MS1	MS0	Duty Description	
		Main Clock(SCC = 0)	Main Clock(SCC = 1)
0	0	2^{14} x N/F_{CH}	2^{6} x N/F_{CL}
0	1	2^{15} x N/F_{CH}	2^{7} x N/F_{CL}
1	0	2^{16} x N/F_{CH}	2^{8} x N/F_{CL}
1	1	2^{17} x N/F_{CH}	2^{9} x N/F_{CL}

2.2 LCDCE1 (LCDC Enable Register 1)

This register is used to control port input, set the blink cycle, and enable LCD pins. Figure 2-3 describes register LCDCE1.

Address	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	Initial value
$0FC5_H$	PICTL	BLSEL	VE2	VE1	COM3	COM2	COM1	COM0	00110000_B

Figure 2-3: LCDCE1 Register

Table 2-4 describes every bit of LCDCE1.

Table 2-4: LCDCE1 Register Description

Register	Description
PICTL	When “1” is written, SEG and COM work as SEG and COM at the same time it can also feedback high or low in just as I/O port input.
BLSEL	When blinking is enabled, writing “1” will select blinking interval to 1s, writing “0” will select blinking interval to 0.5s
VE2	Writing “0” will enable V3 to be general I/O port.
VE1	Writing “0” will enable V2 V1 V0 to be general I/O port.
COM3	Writing “0” will enable COM3 to be general I/O port.
COM2	Writing “0” will enable COM2 to be general I/O port.
COM1	Writing “0” will enable COM1 to be general I/O port.
COM0	Writing “0” will enable COM0 to be general I/O port.

2.3 LCDCE2 to LCDCE6 (LCDC Enable Register 2 to 6)

Those register are used to enable or disable SEG00 to SEG39 to be general I/O port.

Figure 2-4 describes those register.

LCDCE2	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	Initial value
Address	SEG07	SEG06	SEG05	SEG04	SEG03	SEG02	SEG01	SEG00	00000000_B
$0FC6_H$	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
LCDCE3	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	Initial value
Address	SEG15	SEG14	SEG13	SEG12	SEG11	SEG10	SEG09	SEG08	00000000_B
$0FC7_H$	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
LCDCE4	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	Initial value
Address	SEG23	SEG22	SEG21	SEG20	SEG19	SEG18	SEG17	SEG16	00000000_B
$0FC8_H$	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
LCDCE5	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	Initial value
Address	SEG31	SEG30	SEG29	SEG28	SEG27	SEG26	SEG25	SEG24	00000000_B
$0FC9_H$	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	
LCDCE6	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	Initial value
Address	SEG39	SEG38	SEG37	SEG36	SEG35	SEG34	SEG33	SEG32	00000000_B
$0FCA_H$	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	

Figure 2-4: LCDCE2 to LCDCE6 Register

Table 2 – 5 lists how to control those registers.

Table 2-5: LCDCE2 to LCDCE6 Register Description

SEG00 to SEG39	Description
0	Work as general I/O port
1	Work as SEG port

2.4 LCDCB1/LCDCB2 (LCDC Blinking Setting Register1/2)

These two registers are used to enable or disable blinking on or off.

Figure 2-5 describes these two registers.

LCDCB1	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	Initial value
Address	S1C3	S1C2	S1C1	S1C0	S0C3	S0C2	S0C1	S0C0	00000000_B
$0FCB_H$	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	

LCDCB2	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0	Initial value
Address	S3C3	S3C2	S3C1	S3C0	S2C3	S2C2	S2C1	S2C0	00000000_B
$0FCC_H$	R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W	

Figure 2-5: LCDCB1 and LCDCB2 Register

Table 2-6 lists how to use those registers

Table 2-6: LCDCB1 and LCDCB2 Register Description

SnCm	Description
0	Blink off
1	It means SEGnCOMm(SnCm) blink on

3 Steps of Realize LCD in Software

This chapter describes steps of how to realize LCD.

About LCD register they are divided to status register and control register.

Following items will describe how to use these register to realize LCD function.

- ✧ Step one is initializing LCD.

  LCDCC register sets clock, voltage and duty

  LCDCE1 register sets V0~3 and COM work as LCD pin

  LCDCE2 to LCDCE6 registers set SEG work as LCD pin

  LCDCB1/LCDCB2 set blink status of SEG00 to SEG03
- ✧ Step two is clearing LCD display.

  SEG00_01 to SEG30_31 registers write 0x0a to turn all LCDs off.
- ✧ Step three is display data user wanted.

  SEG00_01 to SEG30_31 registers write different data to display different value.

4 LCD Sample Code

This chapter describes MB95F310 LCD C code.

Figure 4-1 describes the initial function.

```
void Init_LCD(void)
{
    LCDCC = 0x4c;  //main clock, STB mode light on LCD, external voltage, 1/4duty
    LCDCE1 = 0x7f;
    LCDCB1 = 0x00;      //blink off SEG00 TO seg01
    LCDCB2 = 0x00;      //blink off SEG02 TO seg03

    LCDCE2 = 0xff;      //work as SEG
    LCDCE3 = 0xff;      // work as SEG
    LCDCE4 = 0xff;      // work as SEG
    LCDCE5 = 0xff;      // work as SEG
    LCDCE6 = 0x00;      // work as i/o port
}
```

Figure 4-1: Initial Code

Figure 4-2 lists the clear code.

```
void LCD_Clear(void)
{
    SEG00_01 = 0;
    SEG02_03 = 0;
    SEG04_05 = 0;
    SEG06_07 = 0;
    SEG08_09 = 0;
    SEG10_11 = 0;
    SEG12_13 = 0;
    SEG14_15 = 0;
    SEG16_17 = 0;
    SEG18_19 = 0;
    SEG20_21 = 0;
    SEG22_23 = 0;
    SEG24_25 = 0;
    SEG26_27 = 0;
    SEG28_29 = 0;
    SEG30_31 = 0;
}
```

Figure 4-2: Clearing Code

Figure 4-3 lists the drive code.

```
void LCD_LigON_NUM(unsigned char Num, unsigned char Dat)
{
    switch(Num)
    {
        case 0x00:
            SEG30_31 = Dis_8_NUM[Dat];
            break;
        case 0x01:
            SEG28_29 = Dis_16_NUM2[Dat];
            SEG26_27 = Dis_16_NUM1[Dat];
        break;
        case 0x02:
            SEG24_25 = Dis_16_NUM2[Dat];
            SEG22_23 = Dis_16_NUM1[Dat];
        break;
        case 0x03:
            SEG20_21 = Dis_16_NUM2[Dat];
            SEG18_19 = Dis_16_NUM1[Dat];
        break;
        case 0x04:
            SEG16_17 = Dis_16_NUM2[Dat];
            SEG14_15 = Dis_16_NUM1[Dat];
        break;
        case 0x05:
            SEG12_13 = Dis_16_NUM2[Dat];
            SEG10_11 = Dis_16_NUM1[Dat];
        break;
        case 0x06:
            SEG08_09 = Dis_8_NUM[Dat];
        break;
        case 0x07:
            SEG06_07 = Dis_8_NUM[Dat];
        break;
        case 0x08:
            SEG04_05 = Dis_8_NUM[Dat];
        break;
        case 0x09:
            SEG02_03 = Dis_8_NUM[Dat];
        break;
        case 0x0a:
            SEG00_01 = Dis_8_NUM[Dat];
        break;
    }
}
```

Figure 4-3: Drive Code

5 Usage Demo

This chapter describes something we must pay attention to when we use register to realize LCD.

5.1 Register Use Attention

- For the duty and bias selecting, the 1/4 duty working with 1/3 bias is recommended
- When selecting external voltage, please connect external circuit to V0~V3

6 Additional Information

For more information about how to use MB95310 EV-board, BGM Adaptor and SOFTUNE, please refer to EV-Board MB2146-450-E User Manual, or visit Websites:

English version:

http://www.fujitsu.com/cn/fsp/services/mcu/mb95/application_notes.html

Simplified Chinese Version:

http://www.fujitsu.com/cn/fss/services/mcu/mb95/application_notes.html

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